DOCUMENT RESUME

ED 198 334 CE 028 023

TITLE	Exploring Careers. Construction Occupations.
INSTITUTION	Bureau of Labor Statistics (DOL), Washington, D.C.
REPORT NO	BLS-Bull-2001-7
PUB DATE	79
NOTE	47p.: Photographs will not reproduce well. For related documents see CE 028 017-031.
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Apprenticeships; Blue Collar Occupations; *Bricklayers; *Building Trades; Career Awareness; Career Choice; *Career Exploration; *Carpenters; Construction Industry; Educational Needs; Education Work Relationship; Employment Qualifications; Junior High Schools; Learning Activities; *Occupational Information; *Plumbing; Resource Materials; Self Evaluation (Individuals); Semiskilled Occupations; Skilled Occupations; Unions; Work Attitudes

ABSTRACT

"Exploring Careers" is a career education resource program, published in fifteen separate booklets, for junior high school-age students. It provides information about the world of work and offers its readers a way of learning about themselves and relating that information to career choices. The publications aim to build career awareness by means of occupational narratives, evaluative questions, activities, and career games grouped in fourteen occupational clusters. This seventh of the series, "Construction Occupations," presents an overview of jobs in the construction industry, such as carpenters, electricians, and bricklayers. Narrative accounts focus on a bricklayer, a carpenter, and a plumber, explaining what they do and how they prepared for their jobs. Exploring sections relate skills needed for these occupations to students' personal characteristics, and learning activities such as inviting a union representative to the class to speak about apprenticeships and joining the Vocational Industrial Clubs of America (VICA) are suggested. A Job Facts section lists nature and places of work, training and qualifications, and other information for nineteen construction occupations. ("Exploring Careers" is also available as a single volume of fifteen chapters.) (KC)

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Exploring Careers

Construction Occupations

U.S. Department of Labor
Ray Marshall, Secretary

Bureau of Labor Statistics
Janet L. Norwood, Commissioner
1979

Bulletin 2001-7

ED198334

CE 028 023

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Exploring Careers is available either as a single volume of 15 chapters or as separate chapters, as follows:

The World of Work and You
Industrial Production Occupations
Office Occupations
Service Occupations
Education Occupations
Sales Occupations
Construction Occupations
Transportation Occupations
Scientific and Technical Occupations
Mechanics and Repairers
Health Occupations
Social Scientists
Social Service Occupations
Performing Arts, Design, and Communications Occupations
Agriculture, Forestry, and Fishery Occupations

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Photography for *Exploring Careers* was directed by Max L. Carey of the Bureau of Labor Statistics, Division of Occupational Outlook. Members of the Division's staff who assisted with obtaining and editing photographs were Anne Kahl, Kathy Wilson, Chester Curtis Levine, and Gloria D. Blue. Contributing photographers were Al Whitley of Whitley Associates, and Harrison E. Allen, Robert Donaldson, and Fleming P. Rose of the U.S. Department of Labor, Division of Graphic Services. The Bureau gratefully acknowledges the cooperation of the many government and private sources that either contributed photographs or made their facilities available to photographers. Depiction of company or trade names in no way constitutes endorsement by the Department of Labor. Some photographs may not be free of every possible safety or health hazard.

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Private Sources

Individuals. Robert Devlin; Robert Miller; The Honorable Eligio de la Garza; The Honorable Henry B. Gonzalez; The Honorable Daniel K. Inouye; and David Weitzer.

Membership groups. Air Transportation Association of America; American Iron and Steel Institute; American Petroleum Institute; Associated General Contractors of America; Association of American Railroads; Chamber of Commerce of the U.S.A.; International Association of Machinists and Aerospace Workers; Motor Vehicle Manufacturers Association of the U.S., Inc.; National Education Association; and United Brotherhood of Carpenters and Joiners of America.

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Publications. Arlington News; Co-ed Magazine; Law Enforcement Communications; The New Prince George's Post, and *The Washington Post.*

Other. Alexandria Archaeology Research Center (Va.); American National Red Cross; Catholic Charities of the Archdiocese of Washington; Folger Shakespeare Library; Forsyth County Heart Association (N.C.); George Washington University Hospital; Model Cities Senior Center (D.C.); St. Columba's Episcopal Church (D.C.); St. Thomas Apostle Catholic Church (D.C.); United Way of America; Visiting Nurse Association of Washington, D.C.; and Washington Hospital Center (D.C.).

Preface

Exploring Careers is a career education resource for youngsters of junior high school age. It provides the kind of information about the world of work that young people need to prepare for a well-informed career choice. At the same time, it offers readers a way of learning more about themselves. The publication aims to build career awareness by means of occupational narratives, evaluative questions, activities, and career games presented in 14 occupational clusters. *Exploring Careers* emphasizes what people do on the job and how they feel about it and stresses the importance of "knowing yourself" when considering a career. It is designed for use in middle school/junior high classrooms, career resource centers, and youth programs run by community, religious, and business organizations.

This is 1 of 15 chapters. A list of all the chapter titles appears inside the front cover.

Exploring Careers was prepared in the Bureau's Division of Occupational Outlook under the supervision of Russell B. Flanders and Neal H. Rosenthal. Max L. Carey provided general direction. Anne Kahl supervised the planning and preparation of the publication. Members of the Division's staff who contributed sections were Lisa S. Dillich, David B. Herst, H. Philip Howard, Chester Curtis Levine, Thomas Nardone, Debra E. Rothstein, and Kathy Wilson. Gloria D. Blue, Brenda Marshall, and Beverly A. Williams assisted.

The Bureau gratefully acknowledges the cooperation of all the workers who agreed to be interviewed and photographed, the teachers and students who field tested a sample chapter, and all who shared their ideas with BLS. Many people in the counseling community offered encouragement and support. Special thanks for her generous assistance go to Cathy Cockrill, Career Education Curriculum Specialist, Fairfax County Public Schools, Fairfax, Virginia.

Although they are based on interviews with actual workers, the occupational narratives are largely fictitious.

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Exploring Careers

Construction Occupations

Ironworkers high above the city are protected by a system of belts and ties.

We live in a world of structures of all kinds: Houses, stores, bridges, factories, roads, and schools. Think about your community for a moment and see how many different structures you can name.

Putting up a building requires the effort of people with many different skills. At every stage, from clearing the site to putting on such finishing touches as signs or door knockers, construction means a team effort. Although the members of this "team" aren't all on the site at the same time, they depend on each other. To get an idea of how this works, let's see what's involved in building a house. We'll follow the progress of the Wright family's house, which you'll read more about in the story about the architect in the chapter on Performing Arts, Design, and Communications Occupations.

Before the Framework Goes Up

A lot had to be done before the house could begin to go up. First, the Wrights' *architect,* Jack Myers, had to design the house and draw up blueprints for the construction workers to follow. Blueprints are plans that show the general layout of the building and give such detailed information as the exact measurements of rooms, windows, and doors and the places where pipes, wires, and ducts should be placed.

Then the builder, or *contractor,* had to obtain all the materials, equipment, and labor. It's the contractor's job to make sure that every phase of the work is done on schedule, so that the house will be finished when the Wrights are ready to move in. This means checking to make sure that the job is being done properly and maintaining an inventory of supplies so that workers don't waste precious time waiting for materials to be delivered. The contractor already has obtained the building permit, a legal document that is required before construction can begin. The permit shows that the Wright house meets county zoning regulations for the site where they plan to build. Several months ago, after obtaining the building permit for the Wrights' house, the contractor hired a *surveyor.* The surveyor measured the land and drew maps that showed boundary lines and such features as roads and underground utility lines.

What else has to be done? The land must be prepared. That will happen soon, for the *operating engineers* are scheduled to arrive tomorrow with their bulldozers and other earth-moving equipment. A hill will have to be leveled and, in spite of the Wrights' desire to save them, several trees will have to be cut down.

The operating engineers are among the first construction workers on the site. Helping them are *construction laborers,* or "helpers", who have work to do during nearly every stage of the building. Once the operating engineers have prepared the ground, the surveyor will come back and use stakes and lines to lay out the exact location of the house on the property.

The Structure Rises

Once the land is ready, it will be time for the foundation to be laid. A building as heavy as a house rests on a foundation buried in the ground. This is done so that the weight of the building will rest on the hard, solidly packed ground below the frost line. Otherwise it might develop structural damage, such as cracks and doors and windows that won't open.

The foundation starts with "footings"—large blocks of concrete that are completely sunk into the ground. Footings are placed under the edges of the house and at certain points inside where there will be extra weight—under a fireplace or porch, for example. The first step in laying the foundation is digging trenches for the footings. An excavation crew of operating engineers will dig out, or excavate, the earth to make room for the footings. Then *cement masons* will pour wet concrete into the trenches. Pouring concrete is hard work that requires strength and stamina. Sometimes this job is done by a crew of construction laborers rather than by the more highly skilled cement masons. Once the concrete is set, bricklayers will come in and place cinder blocks on top of the footings and build the foundation wall to slightly above the ground surface.

Then it's time for utilities to be brought in from the street. Such utilities as water, sewerage, and gas are brought to individual houses by means of undergound pipes called mains that run beneath the streets. The floor of a new house cannot be laid until these water, sewer, and gas mains are tapped and connecting pipes attached that will lead into the house.

After the utility pipes have been brought up through the ground inside the outer boundary of the house, cement masons will pour a slab floor. They will pour the concrete carefully, making sure it is level, and smooth it down as it hardens to give it an even finish. They'll keep the concrete moist while it's "curing" to make sure it will be hard and strong when it dries. It's not unusual for cement masons to work overtime, because once the concrete is poured they must stay on the job until it is completed.

With the foundation and slab floor in place, *carpenters* can begin work on the wooden frame of the house. Carpenters follow the architect's blueprints when they build the frame. They use different sizes of lumber: Studs for the walls, joists for the attic floors, and rafters for the

Laying concrete is a team effort.

roof. They will begin by building the wall framework, nailing pieces of lumber together and securing them to the foundation with metal bolts. The carpenters must be sure to place the studs a certain number of inches apart, as called for in the building code. They must be sure to leave spaces for windows and doors.

As soon as the wall frame is up, the carpenters will build the attic floor frame and the roof frame. On top of the roof frame they'll place sheets of plywood called roof decking. Then *roofers* will come in and put roofing felt or tar paper on the roof deck. Since the architect decided long ago that asphalt shingles would be best for the Wrights' house, that's what the contractor has bought. When the time comes, the roofers will put them on. The roofers will also add gutters, downspouts, and flashing around the chimney and edges of the roof to prevent water from running down the sides of the house when it rains.

Once the roofers have finished, it will be time to put up the outside walls of the house. As the first step, carpenters will nail sheathing boards across the outside of the wall frame. They also will install windows at this stage. When the windows and sheathing board are in place, the outside walls can go up. The Wrights' house will have brick on the front and sides, and aluminum siding on the rear.

Bricklayers will lay the brick. They will have to be sure that the walls are straight and level and that they intersect at right angles. The bricklayers must follow the architect's blueprints very carefully. They have to pay attention to every detail, making sure that the rows of brick line up with doors and windows, for example. Helping them will be *hod carriers* or *mason tenders* who mix the mortar and make sure the bricklayers don't run out of materials.

The aluminum siding for the rear of the house is made at the factory, but the carpenters who install it measure and cut it at the job site. They nail the panels in place and add molding at corners and along windows and doors to give a neat finish.

Carpenters work quickly and accurately with hand tools or power tools.

Precision measuring instruments are required in some construction trades.

A mask protects this plumber's eyes when she is welding.

Construction offers good opportunities for young people who are willing to spend several years learning a trade.

Moving Indoors

All the workers you've read about so far have outdoor jobs. Working together, they'll build the "shell" of the Wrights' house. But there still will be a lot to do before the family can move in.

You've seen how the water, sewer, and gas mains will be tapped before the slab floor is laid down. Until more work is done, the ends of pipes will simply stick out of the floor in the utility room, kitchen, and bathroom. When the time comes, *plumbers* will come in and install the fresh water pipes and the drainage system within the house. They will put pipes inside the walls before closing them up on the inside so that the pipes aren't visible when the house is finished.

Plumbers will install heating and air-conditioning units, too. The Wrights will use electricity to heat their house. Warm air will be sent throughout the building by means of a system of thin-walled rectangular pipes called ducts. *Sheet-metal workers* have already made the ducts at the shop; later they'll bring them to the construction site to install them. The sheet-metal workers will install ductwork inside the walls and ceiling, making sure that there are outlets or registers in each room. They also will install return air ducts so that the air will circulate back to the air conditioner or furnace.

Since both the plumbing and the ductwork are installed inside the walls or ceiling, they're hard to get at once the house is finished. For this reason, the plumbers and sheet-metal workers will have to be very careful to install the pipes and ducts correctly in the first place. They may have to work in awkward or cramped positions to do this.

Another important utility that will be installed is electricity. To do this, *electricians* will connect a cable from the street to the house. They'll bring the cable to the house and attach it to a meter, which measures the flow of electricity, and then to a distribution panel. From this panel the electricians will connect more wires that lead to electrical outlets and switches all over the house. The electricians run these circuit wires inside the walls and ceiling and floors, being careful not to let them interfere with the metal ductwork or plumbing system.

To save energy and keep the house warmer in winter and cooler in summer, insulation will be applied to the insides of the outer walls and to the attic floor. Insulation also helps absorb noise and prevents water vapor from passing through the walls. *Insulation workers* will cut strips of fiberglass or other insulating material to the right length, and then staple each strip into place inside the wood framework. They also will cover the ducts and pipes that carry hot air or water.

Like many construction workers, this painter has his own contracting business.

After the utilities have been roughed in and the insulating materials installed, the finishing work can begin. There will be a lot for the finishing workers to do, for the inside of the house will be no more than a wooden skeleton.

Drywall installers will close up the walls and ceilings by nailing wallboard panels to the wooden framework inside the house. They will cover all joints and nail holes with tape and joint compound, and make sure the surface of the wallboard is smooth and ready for painting.

Years of experience enable this floor installer to work quickly.

Once the wallboard has been installed, *painters* will arrive on the scene. The painters will paint the walls and ceilings, using brushes, rollers, or spray guns. They need to know the characteristics of different paints, and how to mix different colors. Since Mr. and Mrs. Wright want wallpaper on the bedroom walls, *paperhangers* will be needed too. Both the painters and the paperhangers must be skilled at what they do so that they can work rapidly but neatly.

Floor covering installers will be on the job then also. These workers will finish the floors by putting hardwood, resilient tile, or carpeting on top of the concrete slab floor. *Tilesetters* will come in to lay ceramic tile on the floors and walls of the bathrooms.

Finishing carpenters will install the interior wooden trim: Casings around windows and doors and base and shoe moldings where the walls meet the floor. The finishing carpenters also will hang the doors, being careful to make sure each door is the right size and that it hangs straight.

Fixtures and accessories will have to be installed. The plumber will return to put in sinks and bathroom fixtures such as bathtubs and toilets. Finishing carpenters will install kitchen cabinets and counter tops. The electrician will come back to install overhead lights and light switches. The painter will return to finish the hardwood floors, the trim, and any marred or damaged areas.

Various finishing jobs often overlap, so cooperation is essential. The different craftworkers will have to be careful not to get in each other's way or spoil the work that others have done. All of the finishing work affects the final look of the house, and therefore requires careful attention to detail.

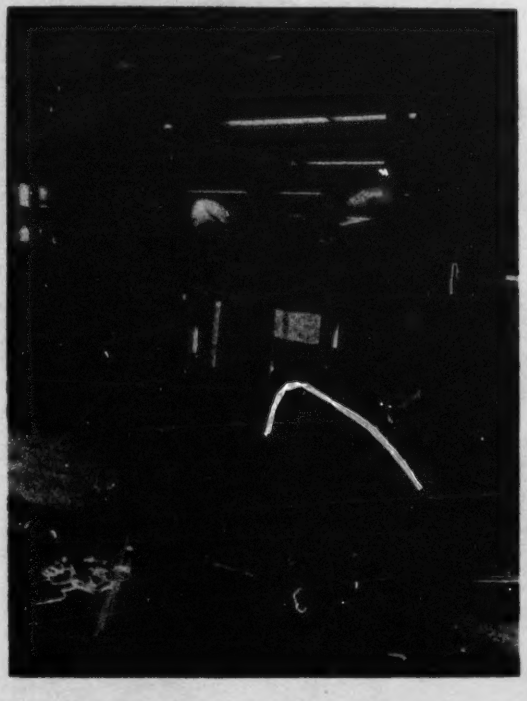
As the inside of the house nears completion, cement masons will return to lay the sidewalks and driveway. A *landscaper* will come in to plant grass, shrubs, or small trees. And then one last step is necessary. A crew of construction laborers will clean up the inside of the house and the work site, and carry away debris left by the finishing workers. Finally, the house will be ready for the Wrights.

Other Jobs in the Building Trades

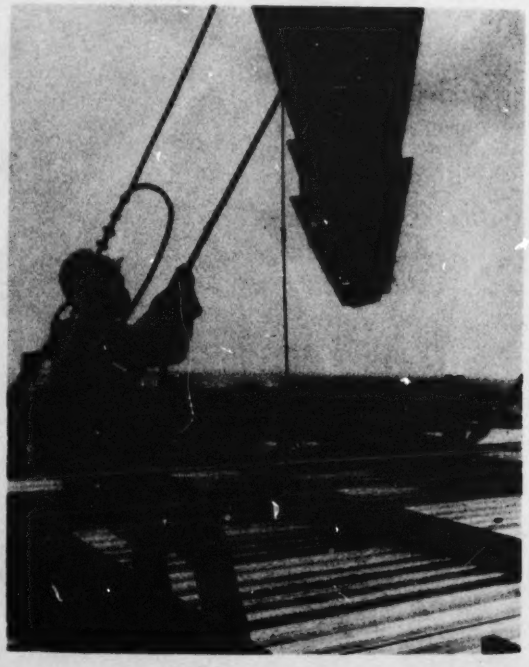
A large project such as a high-rise apartment or an office building requires many more workers than a house. Furthermore, it requires some very specialized workers. On construction projects as large as these, there are jobs for *elevator constructors,* workers who install elevators in high-rise buildings. And jobs for *glaziers,* who install glass on wall surfaces or put in windows. *Ironworkers* erect the steel framework and other metal parts in big buildings, bridges, and other structures. Plaster, rather than drywall, is used to cover walls and ceilings in many commercial buildings. Before any plastering is done, *lathers* install supports such as metal lath or gypsum lath board to hold the plaster, stucco, or concrete materials. *Plasterers* then finish interior walls and ceilings with plaster coatings and apply durable cement plaster or stucco to exterior surfaces. *Marble setters* install marble facing on walls, columns, and floors. *Terrazzo workers* apply terrazzo to floors in buildings such as stores, offices, and hospitals. Terrazzo is tinted concrete with which marble chips are mixed.

What it Takes to be a Construction Worker

As you have just seen, construction takes a team effort. Much of the work takes place one step at a time, and almost every step depends on another having been completed. Cement masons cannot pour concrete footings, for example, until the land has been cleared and trenches have been dug. Carpenters cannot begin nailing up the wall framework until the foundation has been laid. Walls cannot be finished until utilities are installed. Each worker depends on others doing their jobs well and without delay. Since it takes the skills of many different



Glaziers install all types of building glass.



Many people like the physical activity of construction jobs.

people to put up a building, *construction workers must be able to work well with others.* They must be willing to take orders from those in charge, do their share of the work, and cooperate so that no one gets in anyone else's way.

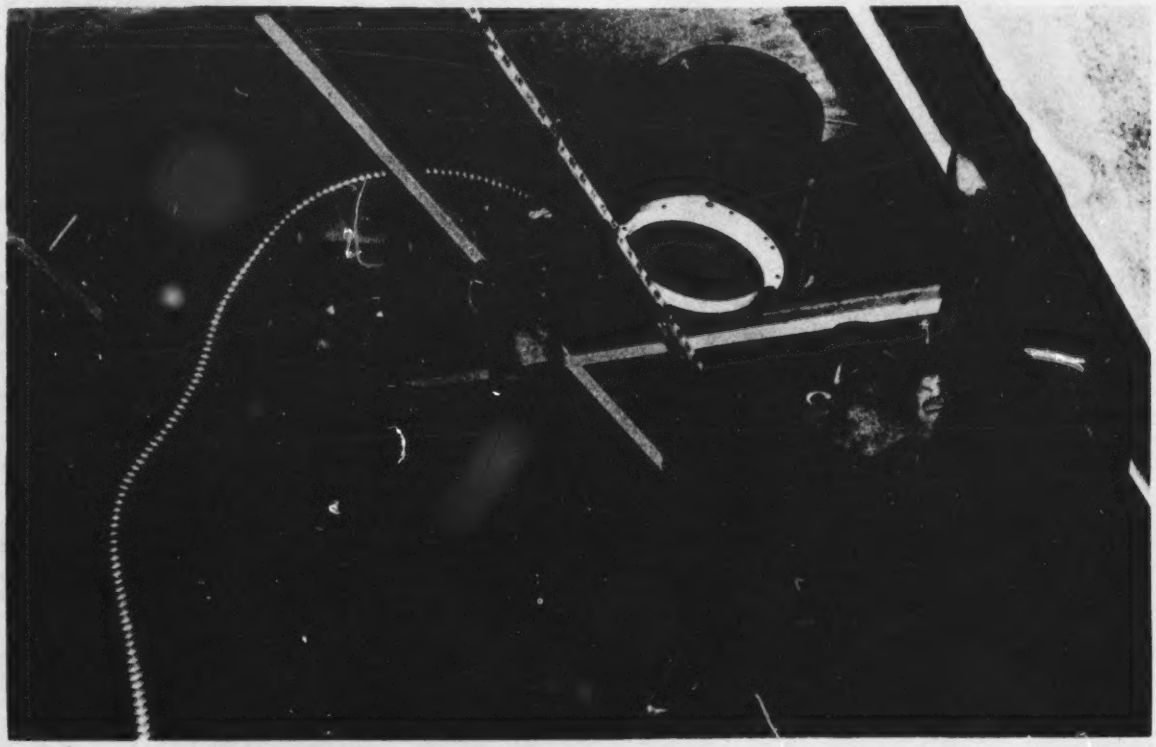
What other traits are important for people in the building trades? For plumbers, painters, electricians, carpenters, bricklayers, and others whose work requires a high degree of skill, a talent for *working with one's hands* is important. It takes manual dexterity to work quickly and accurately with handtools such as the trowels, hammers, mallets, and chisels that bricklayers use. Or to cut and shape wood with portable power saws and drills as a carpenter does. Do you like working with your hands? Are you good at working with tools or machinery? Are you mechanically inclined? These qualities are essential in the building trades.

Skilled construction workers often are called upon to *solve mechanical or structural problems.* A tilesetter might be asked, for example, to create an intricate design in tile for an outdoor patio. With general guidelines from the architect, a plumber might have to plan the layout of a plumbing system for a specific room to make the best use of limited materials and space. Coming up with a workable solution requires that the worker know a great deal about his or her craft. It takes expert knowledge of both the theoretical and practical aspects of a craft or trade to figure out the best way of handling a particular problem.

Much construction work requires *precision.* Workers such as electricians and plumbers must meet strict standards of accuracy in their work; they need to be able to take measurements and calculate dimensions quickly and accurately. This is such an important aspect of construction work that apprenticeship programs generally include one or more courses in applied mathematics.

Many construction workers need to be able to *picture objects from blueprints* and read scale drawings. Also important is an *eye for detail*—the ability to see slight differences and detect flaws in shapes or surfaces. Painters in particular require good *color discrimination* in order to match colors and shades, and to select those that go well together.

Many people prefer construction work because it so often is *outdoor work.* Working outside is enjoyable when the weather is nice, of course. But construction workers have to be prepared to work outside on days when the weather is terrible. Do you spend a lot of time outdoors right now? Would you be willing to work outside in cold or very hot weather?



A 4-year apprenticeship program is the best way to become an electrician.

Finally, every aspect of construction work involves *physical activity.* If you like exercise, one of the construction trades may be just right for you. A willingness to be physically active on the job certainly is a "must" for anyone interested in entering the field, for people in the building trades do a lot of standing, stooping, bending, squatting, stretching, or kneeling. Some construction workers do a great deal of heavy lifting. Moreover, they don't get much time to rest. They must keep moving all the time, working steadily. Depending on the job, construction work can take a lot of strength and stamina.

What the Job Offers You

You've just read about personal traits that are important for construction work. There are other things to consider as well. What about wages? Chances for promotion? Steadiness of the job? Opportunities to go into business for yourself?

The building trades generally offer high hourly pay. Being paid by the hour means that the total earnings of construction workers are affected by how many hours they work. During good times, there's lots of work for everyone. Since construction workers receive extra pay for overtime work, they sometimes can make a lot of money by working overtime to finish a project by a certain deadline.

On the other hand, in construction there's no promise of steady employment. Some construction workers are employed for years by a single contractor, but others must seek a new job after each project is completed. And even if you work for a single contractor, you can't always be sure how many hours you'll work. Construction activity often swings from highs to lows. Building generally is curtailed in the winter when it's very cold, snowy, or rainy. Fewer new homes are built when the economy is in a slump. Work on a big project may stop altogether because of a business failure. A delay in obtaining building materials can lead to temporary layoffs. In these cases being paid by the hour means not getting paid at all for time you don't work. If you're considering construction work, you should be prepared for periods when your income would be uncertain.

Construction Occupations

The building trades offer an opportunity to work your way up to a supervisory position, particularly for workers who are ambitious, and good at what they do. Experience also improves chances for promotion. An experienced worker might be promoted to a position supervising other workers of that craft. After several years he or she might become a construction superintendent, and then perhaps a project manager. Many people in the building trades eventually begin businesses of their own. This is especially true of carpenters, floor covering installers, painters and paperhangers, plasterers, and tilesetters. As their businesses expand, they may employ other workers and become contractors. Sometimes construction workers move into office positions as estimators.

Training

How do people enter the building trades? What do you need to know to get a job? Most construction workers are skilled craftworkers. They learn their trade through several years of on-the-job training—or by completing an apprenticeship or other training program that may take as long as 4 years. Individual training requirements for each of the construction occupations are listed in the Job Facts at the end of the chapter.

Apprenticeship programs, offered by local union and employer groups working together, are a good way of learning one of the construction trades. These programs combine actual work experience with classroom instruction, and may last anywhere from 2 years (cement masons, drywall installers, lathers) to 4 years (carpenters, electricians, glaziers, insulation workers, plumbers, and sheet-metal workers). "Apprenticeship" comes from a French word meaning "to learn", and if you choose this way of training for a trade, you'll need to be serious about learning.

Not everyone trains for construction work in an apprenticeship program, however. Many people learn the construction trades on the job, by working with experienced construction workers in their community. A summer construction job while you're still in high school can be a good way to find out if you're suited for this work.

Construction offers good opportunities for young people who are willing to spend several years learning a trade. Most high schools offer classes in mathematics, mechanical drawing, drafting and design, and shop. Many have programs in the building trades, and offer courses in bricklaying, carpentry, electricity, plumbing, heating and air conditioning, and general maintenance mechanics. These classes provide good experience, because you work with the same kinds of machines and tools in class that you'd use on the job. Such high school courses may give you the skills to land your first job or open the way for further training. Some programs give building trades students an opportunity to participate in the construction or renovation of houses through actual on-the-job work experience.

Many people choose construction work because of the high hourly pay.

Bricklayer

Andy considers himself lucky to get into the apprenticeship program. "I'm being paid good money to learn a highly skilled trade."

Andy walked onto the site and saw Joe, the bricklayer supervisor, examining some blueprints. "Hi," he said, yawning as he approached. "What time is it? This site *would* have to be way on the other side of town. I had to get up an hour and a half earlier than usual this morning to allow enough time to get here."

The supervisor look up, glanced at his watch and said, "It's 7:15. I'm glad you got here a little early today. You can help me lay out these walls."

Andy was an apprentice bricklayer. At the age of 23 he was more than halfway through his 3-year apprenticeship program. The program had two parts: On-the-job training every day and classroom instruction 2 nights a week.

Andy considered himself lucky to have been accepted for apprenticeship. First there had been the aptitude test, and then the oral interview with the union apprenticeship committee. The committee had asked him about his school record, his interests, his hobbies. The last question had been the hardest: What makes you think you'd be a good bricklayer? Andy had passed the interview with flying colors, but even then he had to wait nearly a year before there was an opening. The apprenticeship committee accepts people into the program only a few at a time—it all depends on the amount of construction activity in the area, and the need to train more bricklayers. The committee tries to train only as many bricklayers as there are jobs.

Andy was pleased with the way things were going for him. He was learning a skill and getting paid while learning. Every 6 months since he had started, the apprenticeship committee had examined his progress, and each time they'd promoted him and raised his pay. When he had first started the program he had been paid only about half the usual hourly wage for experienced bricklayers, but the amount had been increasing steadily. Soon he'd be making as much as any experienced bricklayer. Andy knew that with the apprenticeship committee constantly reviewing his progress he couldn't afford to waste time on the job, or skip classes, or be late for work. So there he was even though he'd rather have been home in bed.

That morning Andy and the other bricklayers in the crew were to begin laying the exterior walls of a high-rise apartment building. Andy had learned long ago that there's more to being a bricklayer than just slapping bricks together in a haphazard fashion. Bricklaying, he had discovered, is a precise activity, and there is a lot of measuring to do before the first brick is laid.

The bricklayer supervisor must study the architect's blueprints and compare the dimensions indicated there to the actual surface on which they're working. The blueprints tell the length and width and height of the walls to be built and the kinds of materials to be used. They show the size and locations of doors and windows, the pattern in which the bricks or blocks are to be placed (known as the pattern bond), the number of units needed for a row or "course" of brick or block, and the size of the joints between units. The bricklayers need all of this information before they can begin laying any bricks or blocks.

Andy walked over to look at the architect's blueprints with Joe. Right away, he saw that the wall they were about to build was a composite wall. This meant that the wall was to be made of row upon row of cement block faced with rows of brick. The parallel rows are called wythes. The brick facing and block backing would be bonded with metal wall ties at regular intervals for added strength. The architect had specified exactly what types of brick and block and wall ties to use.

The first step in laying out such walls as these is marking the dimensions on the foundation. Andy and Joe began measuring in from one of the corners of the foundation. They checked the dimensions of the foundation against the dimensions given in the blueprints.

"Let's start laying the bricks out dry," Joe said.

The two bricklayers laid a course of bricks without mortar in order to space them correctly. Then Joe marked the spaces where there were to be doors and windows to make sure that the units would be placed properly around those openings to allow for a strong bond.

Andy got up from his kneeling position and looked at the layout. "It looks pretty good," he said. Joe nodded.

By now the other bricklayers had arrived. In addition to Andy and Joe there were six bricklayers and eight helpers, called mason tenders or hod carriers.

"You'll be working with Fred," Joe told Andy. "He's been doing this for a long time, and he'll be able to help you out if you have any problems." Joe made sure that all of the other bricklayers saw the markings for the doors and windows.

A mason tender brought a batch of freshly mixed mortar, and the bricklayers picked up their trowels. Fred moved to one of the corners. He cut into a pan of wet mortar with his trowel, spread the mortar thickly on the foundation surface, and then pressed a brick into place. He picked up another brick, "buttered" one end of it with mortar, and pressed it into place next to the first brick. After placing each brick in place, he used his trowel to cut off the excess mortar that had been squeezed out from the brick joints.

Andy watched Fred for a while, admiring the single flowing motion with which he loaded the trowel and spread the mortar. Then he stepped up and began helping the other man. Together, they built the outside corner

"There's a lot of more to being a bricklayer than just slapping bricks together. It's very precise work."

of brick, and inside it another one of block. The other bricklayers had split up into smaller groups and had moved to other sections of the building. There they were building corners just as Fred and Andy were doing.

It didn't take long for the crew of bricklayers to build the corners to the desired height. Then they began to lay the brick wall between the corners. First they stretched a line betwen the corner units at the top of the first course. The line was a guide for keeping the bricks all at an even height, as well as for keeping the row straight. Then they began laying the first course of bricks. On top of the first course they laid a second, then a third, and so on until the wall was six courses high.

The motions involved in laying brick are repetitive, and soon Andy was moving at a quick pace. Andy and Fred talked for a while about the upcoming World Series, but then lapsed into silence. "It's nice to be able to talk and let your mind wander while you're working," thought Andy as he listened to some of the other bricklayers joking with each other. The other people on the job really helped make the work enjoyable.

When they finished the sixth course of the brick wall, Andy stopped and examined the work he and Fred had done so far. His arms and back were tired from stooping over and lifting the bricks, but he was pleased with the wall. The sight of the finished brick work made him feel good. The mortar joints between courses still needed to be finished, so Andy picked up a tool called a jointer and ran it along the edge of each joint. The jointer left an indentation in the mortar that made the joints look much neater than before.

The sun was very strong now. Andy could feel it burning his face and arms. His shirt was soaked with perspiration. There wasn't much shade around, nowhere to escape from the heat. "Isn't it lunchtime yet?" Andy wondered.

Minutes later, Joe called out, "Let's break for lunch now. You have half an hour." Then he walked over to Andy and Fred and examined the work they had just completed.

"When we get back," he said, "we'll lay the block backing inside the brickwork."

Andy nodded. Then he looked over at Fred, who grinned and said, "Let's find some shade to sit in so we can cool off. I've got to get out of the sun for a while. And the way you've been working, you must be pretty hot and tired yourself. You're not so bad, you know."

"Thanks," Andy replied, flashing a broad smile. Then the two bricklayers walked off to pick up their lunch bags.

Exploring

Bricklayers work with their hands. They use handtools such as trowels, hammers, and chisels. Sometimes they use power tools.

- Do you enjoy activities that involve working with your hands, such as building ships or airplane models, building or refinishing furniture, making ceramics, weaving, doing macrame, making stained glass, or making candles?
- Are you accustomed to using tools for work around the house or garden, or for repairing bicycles or lawn mowers?
- Do you help put up shelving, install screens or storm windows, replace loose shingles, or fix loose boards or stair railings?
- Do you enjoy learning how to use a tool you've never used before?

"Talking and joking with the other bricklayers is one of the best parts of this job."

Bricklayers follow blueprints and diagrams.

- Can you read and understand graphs, diagrams, and charts?
- Can you read roadmaps?
- Can you look at a drawing and picture the three-dimensional object in your mind?
- Do you understand football or basketball plays when they're written out?
- Can you follow the diagrams in the service booklet for a refrigerator, air-conditioner, or dishwasher?

Bricklayers need a working knowledge of mathematics.

- Do you know how to take measurements and calculate fractions, proportions, and percentages?

Bricklayers do strenuous outdoor work. The job involves a lot of lifting, standing, and stooping.

- Are you in good physical condition?
- Do you enjoy outdoor sports and recreational activities, such as football, baseball, softball, track and field, hunting, fishing, climbing, hiking, or camping?
- Do you prefer mowing the lawn or working in the garden to working indoors?

Suggested Activities

Help build an outdoor masonry structure such as a retaining wall or a barbeque pit. Help lay a terrace or patio. Help lay a brick or stone walkway.

Invite a bricklayer or stonemason to speak to your class about his or her work. Ask the speaker to bring and explain some of his or her tools.

Invite a representative of the local bricklayers' union to speak to your class on apprenticeship opportunities in your community.

Invite the instructor of a bricklaying course to speak to your class about training opportunities and job prospects for bricklayers in your community. Most school systems have vocational education programs that offer instruction in the building trades. Courses also are given in community colleges, technical institutes, and trade schools.

Join a chapter of VICA (Vocational Industrial Clubs of America), if your school has one. VICA chapters plan projects, take field trips, and hold competitions in such skill areas as bricklaying, carpentry, and the electrical trades.

If you are a Girl Scout, see if your local troop has the From Dreams to Reality program for exploring careers. Troops also offer opportunities to test career interests through proficiency badges in a number of areas including Handywoman.

If you are a Boy Scout, try for the merit badge in Masonry.

As a project for a mathematics class, plan a wall to be built of brick or block. This involves deciding on dimensions, pattern bond, and size of joints.

Bricklayers need a working knowledge of mathematics. They need to be able to take measurements and do calculations. See if you can do the problems below. They are typical of some of the problems bricklayers deal with every day.

- A bricklayer is planning to build a wall using standard size bricks that are 8 inches long, 4 inches wide, and 2¼ inches high. There will be ½ inch of mortar between each brick. How long a course can she build with a load of 25 bricks?
- A bricklayer lays 80 bricks per hour. How many hours does it take him to lay 960 bricks? How many 8-hour days is that?
- A bricklayer is planning a wall that is to be 10 feet high and 40 feet long. If seven bricks equal 1 square foot of wall, estimate the number of bricks the job will require if you allow 10 percent for waste.
- It requires ⅝ of a cubic yard of mortar to lay 1,000 bricks with ½-inch mortar joints. Assume that seven bricks equal 1 square foot. How many cubic yards of mortar are needed to build a wall 200 feet long and 10 feet high?

See answers at end of chapter.

Write for career information to the International Masonry Apprenticeship Trust, 815 15th Street, N.W., Suite 711, Washington, D.C. 20005; Associated General Contractors of America, Inc., 1957 E Street, N.W., Washington, D.C. 20006; and Brick Institute of America, 1750 Old Meadow Road, McLean, Virginia 22101.

Related Occupations

Bricklayers aren't the only construction workers who build structures or surfaces using bricks, stones, concrete, mortar, or cement. Can you identify some of the related occupations described below? If you need help, refer to the list of job titles at the end.

1. I spread, smooth, and finish poured concrete surfaces. Who am I?

2. I cut and shape tiles and apply them to walls, floors, ceilings, and roofs. Who am I?

3. I apply cement, sand, pigment, and marble chips to floors, stairways, and cabinet fixtures to create durable and decorative surfaces. Who am I?

4. I build stone structures such as piers or walls. I also lay walks, curbs, or special types of masonry. Who am I?

5. I carry bricks, concrete, mortar, or plaster to bricklayers, plasterers, or stonemasons. I also mix mortar by hand or with a mixing machine. Who am I?

6. I cut and set slabs of marble in floors and walls of buildings. I also polish and repair slabs that already are in place. Who am I?

Terrazzo worker

Cement mason

Marble setter

Hod carrier or mason tender

Stonemason

Tilesetter

See answers at end of chapter.

Carpenter

Brenda has always liked building things. "In high school, I built the props for plays."

"Hey, get that other clamp over there, will you?" Brenda says. She guides a panel of wood into place as the crane swings it towards her. Steve wedges another panel into place while Pete brings the metal clamp, places it on the form, and tightens it. The column form they are building consists of four wooden panels clamped together at opposite corners. They work in silence for a few minutes, placing the clamps about a foot apart all the way to the top. At last, the form stands secure—a tall, boxlike structure about 16 feet high and 4 feet square.

Brenda and Steve are carpenters. Pete is a carpenter's helper. The work they're doing—building concrete forms—is called "rough carpentry". The forms are molds into which wet concrete can be poured to create the large concrete columns that will support the ceiling of a parking garage. Next year there will be a large office building here, and the parking garage will occupy the first two underground levels. High buildings require a lot of concrete, and wherever there's concrete to be poured, carpenters are on the job—building the forms that provide the shape for the concrete.

Brenda and her co-workers are working outside, in the center of the second level of the parking garage. Since there aren't any columns up yet in the area where they're working, there's no concrete slab above to serve as a roof. Luckily, the sun is out and it's a beautiful spring day.

Brenda feels that being a carpenter helps her stay in good physical condition.

Today Brenda, Steve, and Pete will spend most of the day putting up column forms. Tomorrow, they're likely to be doing something different. The parking garage is in many different stages of construction, most of which require some kind of rough carpentry.

At one end of the parking garage, the second level is just being started. There a crew of carpenters is laying down the plywood decking onto which the wet concrete will be poured to form the second-level slab floor.

At the other end, things are further along. The slab floor for the second level has been laid and columns already are in place. There another crew of carpenters is busy putting up the lumber that will support or brace the plywood decking onto which the concrete slab above will be poured. To do this, the carpenters nail or brace pieces of lumber called jacks, ribs, and stringers to form an overhead frame on which they can nail the sheets of plywood.

"Maybe we'll be working over there by the end of the week," Brenda thinks to herself. She's not looking forward to it. Putting up the ribs and stringers can be dangerous work. To put up the ribs, for example, the carpenters often balance on one rib (a long piece of lumber only 4 inches wide and 4 inches thick) while they're spreading down the one next to it. Just last week one of the carpenters fell backwards off a rib and landed on his back 15 feet below. He's in the hospital now and will be out of work for some time. The carpenters have to be especially careful to avoid that kind of accident.

Brenda will probably spend most of tomorrow stripping column forms. She'll remove the forms from columns in which the concrete has begun to set. That can be a rough job, because the wooden forms stick very tightly to the concrete that has hardened against them, and the carpenters must use a combination of leverage and strength to get them off. Once the carpenters have stripped the forms, they'll coat the insides with form oil to help the forms separate more easily from the hardened concrete next time they're used. When this fluid dries overnight, the forms will be ready to be used again the next day.

As soon as they finish one form, Brenda moves on and begins constructing the next one. You never know when a supervisor's going to be watching you, she figures, and those who don't do their share of the work are most likely to be laid off when things get slow.

"Hey, you don't get tired very easily, do you? Where'd you learn carpentry, anyway? You're good!"

Brenda smiles at the compliment, so different from the treatment she's gotten at other jobs. Why, just a few years ago, people always seemed to be asking why she

Brenda has lunch with her co-workers.

wanted to do "a man's job." Brenda never thought of carpentry as "man's work." It's something she's always been good at and enjoyed doing. Suddenly she realizes that Steve is waiting for an answer.

"Well, I just picked it up, I guess," she begins. "The way you did, probably. I was always building things as a kid. Then, in high school, I got interested in the theater and built the props for plays. The more carpentry work I did, the more I found myself enjoying it.

"That was all there was to it until I found out how much carpenters get paid around here! The chance to make a lot of money convinced me to try to make a career of carpentry. Right after high school I applied for a job with a small construction company that needed carpenters pretty badly. Since then I've gained experience and picked up new skills by working on different kinds of construction jobs.

"Now," she says, changing the subject, "why don't we get this last form built and then move over to the other side?"

There are plenty of people working on the site today. Construction jobs haven't been so easy to come by lately, and so most of these workers feel lucky to be out here working. At least Brenda doesn't have to drive too far to get to work each day. Some of the other carpenters live in another State, and have to commute over 3 hours each way to get to and from work. "When you have to be at work at 7 a.m., that makes for a very long day," she thinks.

Besides the carpenters, the workers on the construction site are mostly cement masons or rodbusters. The rodbusters work with the form carpenters, preparing for the pouring of the concrete. Their job is to install the steel rods that will give added strength to each column. The rodbusters attach the steel rods with wire to other steel rods, called dowels, that are sticking up out of the concrete slab. Once this is done the spot is ready for the carpenters to come and build the form around the rods.

Carpenters have been on the site almost since construction began. When the form work runs out, most of the form carpenters will move on to another site to begin the same type of work on another project. However, Brenda will try to stay on at this site and do some of the other carpentry jobs that will need to be done, installing drywall, for example. In times like these, when construction isn't exactly booming, Brenda knows that to stay employed year-round it helps to be versatile. She's made it a point to learn to handle as many different kinds of carpentry work as possible. During the 5 years she's worked as a carpenter she's learned how to install acoustical tile and drywall, and how to hang doors. These skills, she believes, give her an advantage over some of the other carpenters.

"So, do you think you're going to stay on in construction?" Steve asks as they move over to another column location.

"Sure," Brenda replies quickly. "Maybe someday I'll have a contracting business of my own."

"Great idea," says Steve. "Well, you know what you're doing, that's for sure."

As he walks away, she thinks to herself, "Doing a good job is what counts, after all." Brenda takes pride in

doing work of high quality and knows that she's earned the respect of most of her fellow workers. She's looking forward to many more years in carpentry.

Exploring

Carpenters work with their hands. They use both hand and power tools and must handle their tools quickly and skillfully.

- Do you like working with your hands?
- Are you handy with repairs around the house?
- Are you good at working with tools?
- Do you enjoy such activities as building ship or airplane models, building or refinishing furniture, framing pictures, making ceramics, weaving, or doing macrame?
- Are you accustomed to using tools for work around the house or garden, or for repairing bicycles or lawn mowers?
- Have you ever helped put up shelving, install screens or storm windows, replace loose shingles, paint, or fix loose boards or stair railings?
- Do you enjoy learning how to use a tool you've never used before?

Carpenters follow blueprints and diagrams.

- Can you read and understand graphs, diagrams, and charts?
- Can you read road maps?
- Can you look at a drawing and picture the three-dimensional object in your mind?
- Do you understand football or basketball plays when they're written out?
- Can you follow the diagrams in the service booklet for a refrigerator, air-conditioner, or dishwasher?

Carpenters need a working knowledge of mathematics.

- Do you know how to take measurements and calculate fractions, proportions, and percentages?

Carpenters do strenuous outdoor work. The job sometimes involves prolonged standing, climbing, and squatting.

- Are you in good physical condition?
- Do you enjoy outdoor sports and recreational activities, such as football, baseball or softball, track and field, hunting, fishing, climbing, hiking or camping?
- Do you prefer mowing the lawn or working in the garden to working indoors?

Suggested Activities

Build a doghouse or birdhouse. Build a bookcase, table, or other piece of furniture.

Build the props for a school theatrical production.

Volunteer to repair toys at a day care center, Headstart program, or nursery school.

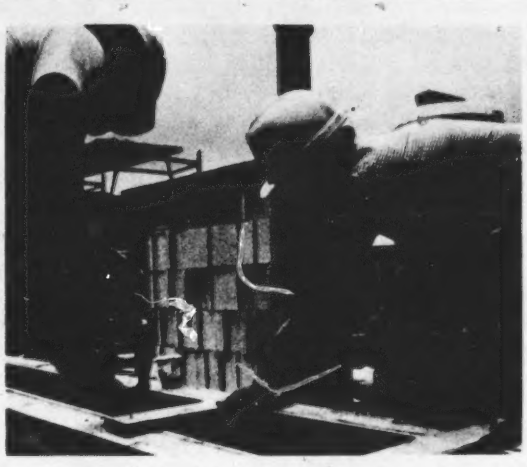
Offer to do minor home repairs or help winterize the homes of elderly neighbors. There may be a program of this kind in your community to which you could volunteer your services. To find out, call the local voluntary action center or agency on aging.

Help renovate a room or building for a teen club or community center.

Invite a carpenter or cabinetmaker to speak to your class about his or her work. Ask the speaker to bring and explain some of his or her tools.

Carpenters need a working knowledge of mathematics. They need to be able to take measurements and do calculations. See if you can do the problems below. They are typical of some of the problems carpenters might deal with.

- A carpenter must use an auger bit to drill a hole exactly ⅝ of an inch deep. The bit advances 1/16 of an inch for each turn. How many turns are needed to



"Someday I hope to have a contracting business of my own," says Brenda.

drill the hole?

- A carpenter must place flooring on a concrete slab that is 8 feet by 15 feet. She will be using pine flooring boards that are sold as 1" × 4" × 8'. The carpenter knows, however, that as a result of planing, boards this size are actually ¾" × 3 ¾" × 8'. How many boards will she need for the job?
- An 8-inch-wide rough board is finished by planing ⅞ inch off one side and ¾ inch off the other side. What is the width of the finished board?
- A carpenter is estimating the amount of time required to do a roofing job. He estimates the job will require 20,000 tiles and he knows he can install 1,000 tiles in 1 hour and 45 minutes. How many 8-hour days will be required to complete the job?

See answers at end of chapter.

Invite the instructor of a carpentry course to speak to your class about training opportunities and job prospects in your community. Most school systems have vocational education programs that offer instruction in the building trades. Courses are given in community colleges, technical institutes, and trade schools.

Join a chapter of VICA (Vocational Industrial Clubs of America), if your school has one. VICA chapters plan projects, take field trips, and hold competitions in such skill areas as carpentry, bricklaying, plumbing, and the electrical trades.

Invite a representative of the local carpenters' union to speak to your class about apprenticeship opportunities in your community.

Invite a woman carpenter to speak to your class about her job and how she got started in the field.

If you are a Girl Scout, see if your local troop has the From Dreams to Reality program for exploring careers. Troops also offer opportunities to test career interests through proficiency badges in a number of areas including Handywoman.

If you are a Boy Scout, try for the Home Repair merit badge.

Eventually, as the United States converts to the metric system, all construction materials will be based on metric sizes. Lumber, concrete blocks, floor and ceiling tiles, bricks, sacks of cement, roofing paper, shingles, doors, and windows will be made in metric sizes and buildings will be designed accordingly. Rules and tapes with metric measures will become familiar.

Use the topic of metrics in woodworking for a report in a mathematics class. You might begin your research by writing for information to the Office of Weights and Measures, National Bureau of Standards, Washington, D.C. 20234. They also will supply a list, by State, of speakers who are willing to talk to groups about the metric system.

Write for career information to the Associated General Contractors of America, Inc., 1957 E Street, N.W., Washington, D.C. 20006 and to the United Brotherhood of Carpenters and Joiners of America, 101 Constitution Avenue, N.W., Washington, D.C. 20001.

Related Occupations

Carpenters are the largest group of building trades workers, and are employed in almost every type of construction activity. A wide variety of jobs are performed by people with different types of carpentry skills and different job titles. To learn more about some of them, match each occupation in column A with the correct description (in column B) of the objects on which such workers work.

Column A	*Column B*
1. Acoustical carpenter	a. Interior and exterior trim, stairs, hardwood floors
2. Rough carpenter	b. Drywall and other wallboard for ceilings and walls
3. Carpet layer	c. Frames of buildings, general carpentry work in residential construction
4. Cabinetmaker	d. Acoustical tile for walls and ceilings
5. Finish carpenter	e. Concrete forms, scaffolds, temporary frame shelters
6. Framing carpenter	f. Wooden store fixtures, office equipment, cabinets, and high-grade furniture
7. Drywall installer	g. Carpeting installations

See answers at end of chapter.

Plumber

Bob looks over plans for the school's plumbing system.

Bob makes his way down the main hall of what soon will be a brand new high school. Painters are on the job now, and Bob has to step carefully around their equipment—ladders, paintbrushes, rollers, cans of paint, and dropcloths.

Bob's in charge of a crew of plumbers. He's been around this site almost since construction began and knows the layout of this building backwards and forwards. Not only does he know the blueprints, he helped design the plumbing system that runs through every part of the building much like the blood vessels in our own bodies. Installing the plumbing for this school was a big job. Bob guided the other plumbers through the entire process, relying on the basic knowledge he gained during his apprenticeship, and the 8 years of experience he's had since then.

The plumbing crew arrived at the site over a year ago, right after the excavation crew left. One of their first jobs was tapping the water and gas mains that lie beneath the city streets. This involved drilling a hole in each of the mains running under Market Street, where the school is located, and installing pipe to run from the main to the school. The plumbers installed underground piping systems for the fresh water that would be brought to the school, as well as for the natural gas that would fuel the school's heating system.

At the same time, the plumbing crew installed the underground clay pipes that carry water waste away from the school. This job involved installing two separate systems of pipes—a sanitary sewer system and a storm sewer system. The school's sanitary sewer system feeds into the city system, which in turn carries waste to the local sewage treatment plant. A separate piping system was installed to handle water runoff. The school's storm sewer system drains water from the athletic fields, from the school parking lot, and from the yard right around the building. Not all of the storm runoff can be thrown together immediately, however. The water from the parking lot, for example, will have oil deposits mixed in it which must be filtered out before this water can be mixed with other runoff and emptied into a lake or river. The plumbers therefore had to lead pipes from the parking lot to a separate chamber where the rainwater runoff could be cleaned up before being channelled into the city's storm sewer system. Installing all that underground pipe took quite some time.

Through the windows that line one side of the hall, Bob sees that it's still gloomy and overcast outside. The weather reminds him of the rainy spring they had while they were putting in those sewer pipes. The plumbers lost more work time than usual because of the heavy rains. And when the rain let up, they found themselves ankle-deep in mud. It wasn't exactly a picnic, working outside in a fine rain, slipping and sliding in the mud. But how quickly a sunny day restored everyone's spirits! On those beautiful days in May, Bob and his crew forgot all their gripes about the weather. In fact, they had had quite a few laughs about all those people with indoor jobs who couldn't enjoy the great weather . . .

After the underground piping systems were installed, the plumbers left the site while the shell of the building was put up. Then the plumbers returned to install pipes inside the walls, ceilings and floors. Although the architect had shown in his floor plans where the fixtures would be placed and how the pipes would run, his diagram actually left much to the plumbers' ingenuity. Using the architect's plans as a guide, Bob and Ted Jones, the plumbing contractor Bob works for, drew up detailed plans for the plumbing system. These plans showed the other plumbers exactly where to lay the pipes, what angles to use at each turn, what size pipes, and what kinds of supports to use.

The plumbers had to design and install several different piping systems for use inside the school. There were the hot and cold water lines that led to the bathroom sinks and to the sinks in the home economics room. Other cold water lines led to sinks in the art rooms and the science laboratories, and to the water fountains in the halls. Cold water lines also led into the fire extinguisher system. In addition, drainage pipes had to be led away from each of the fixtures, and venting pipes had to be installed to allow air into the drain system.

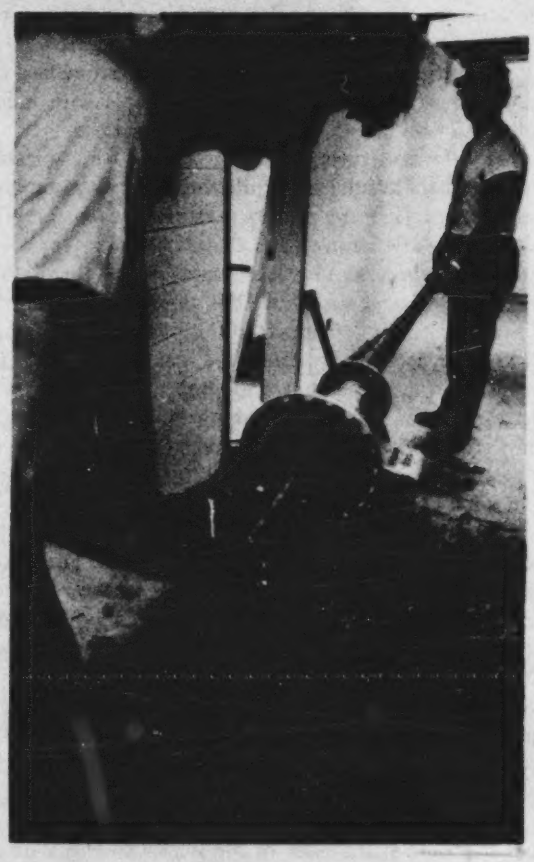
Bob turns a corner in the hall and heads toward the locker rooms at the back of the school to check on the plumbers' progress there. On the way he passes Jack, one of the young plumber apprentices, who is installing metal registers in the hallway. These registers are the last part of the school's heating system to be installed. Earlier, the plumbers had installed the furnace that will burn the gas to heat the air.

"How's it going, Jack?" Bob calls out.

"Just fine," answers Jack, looking up quickly.

Jack's a good worker. He takes his job seriously and never hesitates to ask questions if there's something he's not sure of. Something about Jack's determination to make the most of his apprenticeship reminds Bob of his own start in the trade.

Bob had been accepted in the apprenticeship program right after he graduated from high school. The program lasted 4 years, and during that time Bob was assigned to a variety of projects, from large office buildings to small housing developments. Twice a week he attended classes at night. The combination of classroom instruction and on-the-job training gave him the thorough preparation he needed for becoming skilled and versatile in his trade. After serving his apprenticeship, Bob spent the next 5



Bob helps Jack cut pipe. Jack is learning the trade through a 4-year apprenticeship.

years working at a number of different jobs. As soon as he heard of a construction project nearby, he'd apply for work and stay with the job until the plumbing installation was finished. Then he'd move on to another construction site. Three years ago, Bob decided that he wanted a more permanent job. That's when he started working for Ted Jones, the plumbing contractor. Ted was impressed with Bob's work and his knowledge of the field, so impressed that after less than 2 years he put Bob in charge of the other plumbers in his crew.

This school is the biggest plumbing project Bob's been responsible for so far. Although he was in charge of the plumbing crews on two other projects last year, they were much smaller jobs. However, the solid training he had as an apprentice and his years of experience as a plumber make him sure of himself, even in a job this big. He's been around construction for more than a dozen years, after all—long enough to know what needs to be done, when to do it, and what problems to expect. If he handles jobs like this one as well as he expects to, he may be able to move up to the job of project superintendent before too long. That would mean overseeing an entire construction job and coordinating the work of people in all the building trades, not just the plumbers.

Bob's thoughts are interrupted as he notices Carl walking toward him from the other end of the hall. Carl's a veteran member of his plumbing crew.

"Say, Bob," Carl calls out. "The truck with the sinks and toilets just pulled up, and we're starting to unload. We can start installing the fixtures right away. Do you want us to start with the locker rooms?"

"Right," Bob answers. "I'm going that way right now."

The plumbing crew had put in the piping systems and supports some time ago, before the inside walls were closed up. Heavy fixtures like large sinks and water fountains need plenty of support, so the plumbers had mounted special hangers, screwed into strong supporting braces inside the walls. Now that the walls were finished, there was no sign of any of this plumbing work. Only the fixtures that they were about to install would give evidence of the plumbers' hard work.

Bob makes his way outside now to watch a group of construction laborers unloading some of these fixtures from a large truck.

"Careful, now," he warns as he approaches the truck, where one laborer is pulling at a commode. "That's about 60 pounds of pretty expensive china." The laborer reaches for it more carefully, picks it up and takes it into the school. The plumbers must be strong enough to hold such fixtures in place while bolting them into the wall.

Bob watches while more commodes, some sinks, and some water fountains are unloaded. Things have been running smoothly today, and Bob is feeling good about his job. Bob thrives on his work as a supervisor; he likes organizing the work, supervising the other plumbers, and managing day-to-day problems. And since he likes being on the go all the time, the busy pace is fine with him. He's learning a lot, too. His job gives him a broad view of all the phases of a construction project, and how they fit together. Plumbing is still his favorite construction activity, of course. And in his job as supervisor, Bob has gotten a clearer idea of the variety of tasks that this craft entails. With that thought, Bob turns to go back into the school.

Exploring

Plumbers work with their hands, using handtools such as wrenches, hammers, chisels, and saws. Sometimes they use power tools and gas or acetylene torches.

Carl is the most experienced plumber on Bob's crew.

- Do you enjoy activities that involve working with your hands, such as building ship or airplane models, building or refinishing furniture, framing pictures, making ceramics, doing macrame, or making candles?
- Are you good at working with tools?
- Do you enjoy learning how to use a tool you've never used before?
- Are you handy with repairs around the house?
- Do you help put up shelving, install screens or storm windows, fix loose boards or stair railings, or fix leaky faucets?
- Do you know how to repair a bicycle or lawn mower?
- Do you enjoy working on motorcycle or automobile engines?

Plumbers often have to search for the cause of a problem. They need to know mechanical principles and understand how things work.

- Are you curious about how things work?
- Would you take something apart—your bicycle or an alarm clock, for example—just to see how it's put together?
- Do you try to solve problems in an orderly and logical way?
- Are you persistent? Will you work on a problem until you solve it?

Plumbers follow blueprints and diagrams.

- Can you read and understand graphs, diagrams, and charts?
- Can you read roadmaps?
- Can you look at a drawing and picture the three-dimensional object in your mind?
- Do you understand football or basketball plays when they're written out?

- Can you follow the diagrams in the service booklet for a refrigerator, air-conditioner, or dishwasher?

Plumbers need a working knowledge of mathematics and science.

- Do you enjoy mathematics and science courses?
- Do you know how to take measurements and calculate fractions, proportions, and percentages?

Each plumbing job is a little different from the rest.

- Do you like variety and change in your daily or weekly schedule?

A plumber's work can be strenuous. It involves a lot of standing, stooping, lifting, and squatting. Much of it is done outdoors.

- Are you in good physical condition?
- Do you like to be active most of the time?
- Do you enjoy outdoor sports and recreational activities, such as football, bicycling, softball, track and field, hunting, fishing, climbing, hiking, or camping?
- Do you prefer mowing the lawn or working in the garden to working indoors?

Suggested Activities

Help with minor plumbing repairs at home. Help your parents replace a washer in a leaky faucet or clean out a sink trap. Your public library has books on home repairs that can guide you.

If there is a home repair or winterization program in your community, volunteer to assist one of the plumbers. To find out if there is such a program where you live, check with your local voluntary action center or agency on aging.

Help family and friends with automobile engine repairs. Do your own repair work for your bicycle. Mechanical work of this kind will give you practice working with small handtools.

Invite a plumber to speak to your class about his or her job. Ask the speaker to bring and explain such tools as wrenches, reamers, drills, braces, and bits.

Invite the instructor of a plumbing course to speak to your class about training opportunities and job prospects in your community. Many school systems have vocational education programs that offer instruction in the building trades. Courses also are given in community colleges, technical institutes, and trade schools.

Join a chapter of VICA (Vocational Industrial Clubs of America), if your school has one. VICA chapters plan projects, take field trips, and hold competitions in such skill areas as plumbing, carpentry, bricklaying, and the electrical trades.

Invite a representative of the local plumbers' union to speak to your class about apprenticeship opportunities in your community.

If you are a Girl Scout, see if your troop has the From Dreams to Reality program of career exploration. Troops also offer opportunities to test career interests through proficiency badges in a number of areas including Handywoman.

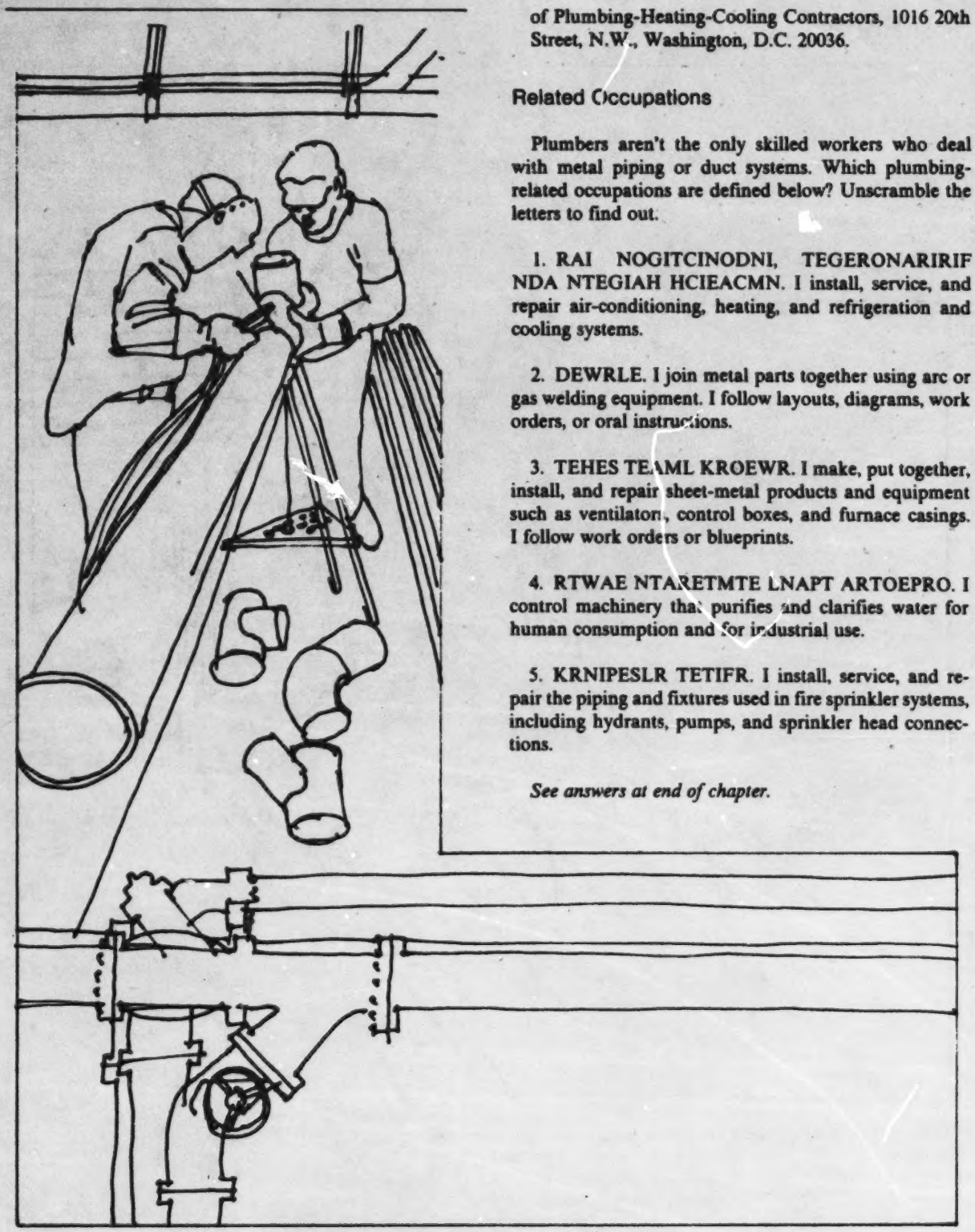
If you are a Boy Scout, try for the Plumbing and Home Repairs merit badges.

Mathematics is an important tool of the trade for plumbers. They must be able to take measurements and do calculations. See if you can do the problems below. They are typical of some of the problems plumbers might deal with.

- The water pressure in a main supplying an irrigation system is 68 pounds per square inch. If the pressure at the nozzles is ⅜ of the main pressure, what is the pressure at the nozzles?
- A plumber cuts the following lengths from a 40-foot piece of pipe: 6 ¾ feet, 4 ⅛ feet, 7 ½ feet, 2 ⅔ feet, 5 $\frac{5}{12}$ feet. How much pipe is left?
- The weight of a pipe is directly proportional to its length. If a pipe 8 feet 4 inches long weighs 75 pounds, how much does a pipe 6 feet 8 inches long weigh?
- A house drain has a run of 40 feet at a grade of ⅛ inch per foot. The low end has an elevation of 96.25 feet. What elevation is the high end?
- Water weighs nearly 8⅓ pounds per gallon. A gallon equals 231 cubic inches. How many gallons of water are there in a full tank with a volume of 2,079 cubic inches, and how much does this water weigh?

See answers at end of chapter.

Write for career information to the National Association



of Plumbing-Heating-Cooling Contractors, 1016 20th Street, N.W., Washington, D.C. 20036.

Related Occupations

Plumbers aren't the only skilled workers who deal with metal piping or duct systems. Which plumbing-related occupations are defined below? Unscramble the letters to find out.

1. RAI NOGITCINODNI, TEGERONARIRIF NDA NTEGIAH HCIEACMN. I install, service, and repair air-conditioning, heating, and refrigeration and cooling systems.

2. DEWRLE. I join metal parts together using arc or gas welding equipment. I follow layouts, diagrams, work orders, or oral instructions.

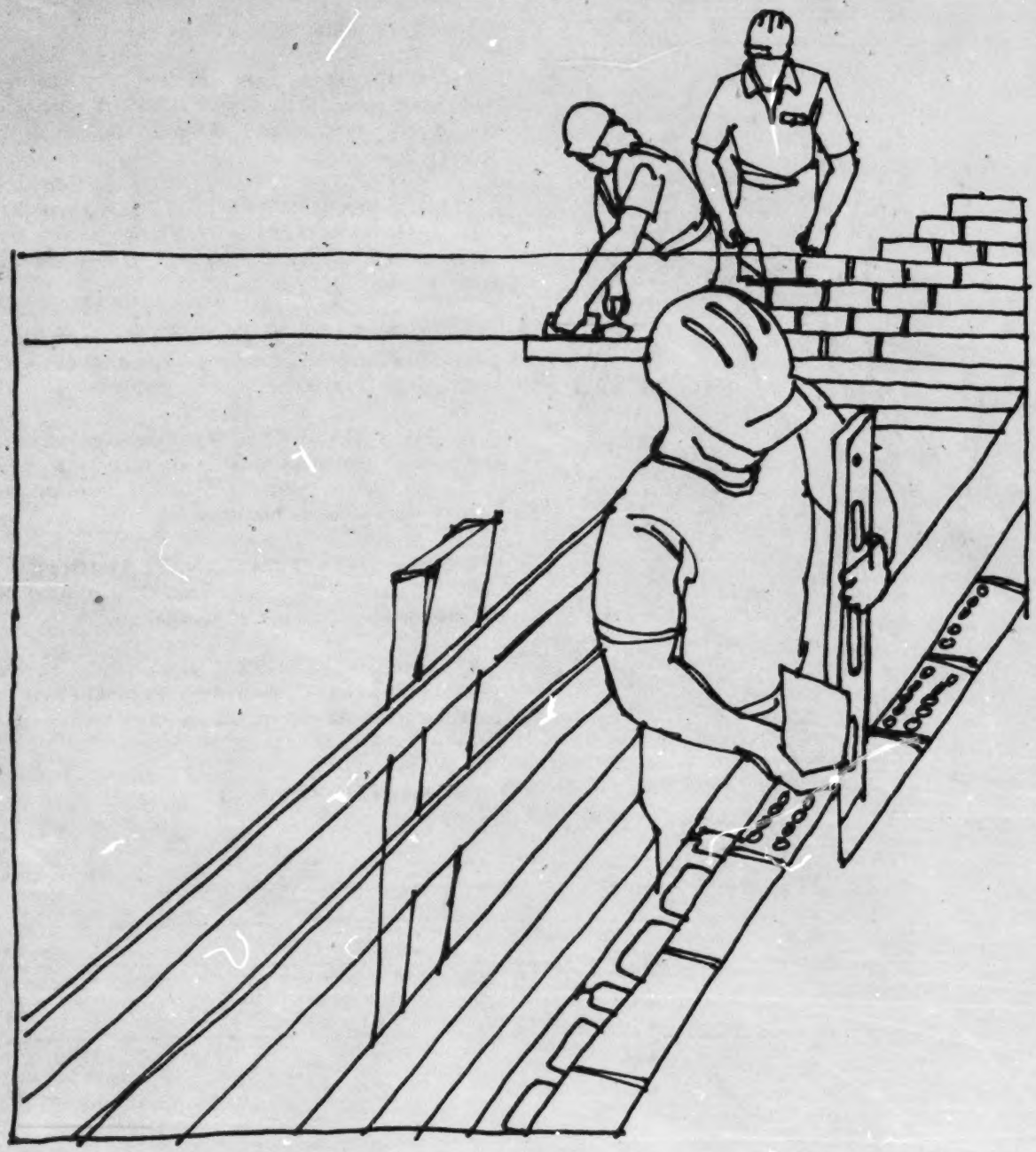
3. TEHES TEAML KROEWR. I make, put together, install, and repair sheet-metal products and equipment such as ventilators, control boxes, and furnace casings. I follow work orders or blueprints.

4. RTWAE NTARETMTE LNAPT ARTOEPRO. I control machinery that purifies and clarifies water for human consumption and for industrial use.

5. KRNIPESLR TETIFR. I install, service, and repair the piping and fixtures used in fire sprinkler systems, including hydrants, pumps, and sprinkler head connections.

See answers at end of chapter.

Job Facts



There isn't room in this book for a story about every construction occupation. However, you'll find some important facts about 19 of these occupations in the following section. If you want additional information about any of them, you might begin by consulting the Department of Labor's *Occupational Outlook Handbook*, which should be available in your school or public library.

Construction Occupations

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Bricklayers, Stonemasons, and Marble Setters	Workers in these crafts build and repair structures such as walls, fireplaces, patios, and walkways using brick, tile, terra cotta, marble, and other materials. Most work for building contractors. Bricklayers work throughout the country, but most stonemasons and marble setters work in metropolitan areas. In cities that are too small to have a demand for full-time masons or setters, bricklayers may install stone or marble as a sideline. Many bricklayers are self-employed and specialize in contracting on small jobs such as patios and fireplaces. Bricklayers work on all kinds of buildings, but because stone and marble are expensive, stonemasons and marble setters work mostly on high cost buildings such as offices, hotels, and churches.	Most bricklayers, stonemasons, and marble setters learn their skills informally by working as helpers or hod carriers. They start with carrying materials, moving scaffolds, and mixing mortar. It takes several months to a year before they are taught to spread mortar and lay brick. Other workers in these crafts learn their skills through apprenticeship, which involves 3 years of on-the-job training plus classroom instruction in such subjects as blueprint reading, mathematics, and sketching. A high school education is important for entry into an apprenticeship program. Manual dexterity is important, because these workers use handtools such as trowels, brick and stone hammers, wood or rubber mallets, and chisels. For exacting cuts of brick, stone, or marble, they use electric saws with special cutting blades. The work can be strenuous because it involves lifting and prolonged stooping and standing. Most of the work is performed outdoors.	Many bricklayers, stone masons, and marble setters are union members.

Exploring Careers

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Carpenters	Carpenters construct, remodel, and repair wooden structures. They are the most numerous of all building trades workers, and work in almost every kind of construction activity. The work is commonly divided into two categories: "rough" and "finish" carpentry. Rough carpentry involves erecting the wooden framework of a building, making forms for concrete, and putting up scaffolds. Finish carpenters install molding, wood paneling, cabinets, window sash, and so forth. Skilled carpenters can do both kinds of work. Most carpenters work for contractors, but many are self-employed. Some carpenters alternate between working for contractors and doing small jobs on their own. Some carpenters do construction work in factories, government installations, mines, shipyards, and large buildings.	An apprenticeship program is recommended as the best way to learn carpentry. Apprenticeship usually consists of 4 years of on-the-job training plus classroom instruction in drafting and blueprint reading, mathematics, and the use of woodworking machines. Training may also be acquired on the job. A high school education or its equivalent is desirable. Some knowledge of the trade may be obtained through vocational school courses in carpentry and shop. Manual dexterity is important because carpenters use handtools such as hammers, saws, chisels, and planes and power tools such as portable power saws, drills, and rivet guns. Good physical condition, a good sense of balance, and a lack of fear of working at heights also are important attributes for carpenters.	Carpenters have greater opportunities than most other construction workers to become supervisors since they are involved in the entire construction process. Some become contractors and run their own businesses. Many carpenters are union members.
Cement Masons and Terrazzo Workers	Cement masons mix, pour, and finish concrete for projects ranging in size from small patios to large office buildings to huge dams. Terrazzo workers apply a mixture of concrete and marble chips to surfaces to create attractive floors and walkways. Most masons specialize in small jobs, such as driveways, sidewalks, and patios; most terrazzo workers specialize in floors. Cement masons work for general contractors who construct entire projects, and for contractors who only do concrete work. Most terrazzo workers work for special trade contractors who install decorative floors and wall panels.	Cement masons and terrazzo workers learn their trade either through on-the-job training as helpers or through 2- or 3-year apprenticeships. On the job, helpers begin with simple tasks, but usually are doing finishing work within a year. In the apprenticeship program, apprentices learn applied mathematics, blueprint reading, and safety. Three-year apprentices receive special instruction in layout work and estimating. Masonry or terrazzo work is active and strenuous, and requires much stooping, bending, and kneeling. Cement masons and terrazzo workers therefore need physical strength and stamina.	Cement masons often work overtime, because once the concrete has been poured the job must be completed. They generally receive premium pay for overtime work. Many cement masons and terrazzo workers are union members.

Construction Occupations

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Construction Laborers	Laborers under the direction of other trade workers provide much of the routine physical labor on construction and demolition projects. They erect and dismantle scaffolding and clean up rubble and debris. Laborers also help unload and deliver materials, machinery, and equipment to other construction workers. Construction laborers work on all types of construction projects. They work for construction contractors, for State and city public works and highway departments, and for public utility companies.	Little formal training is required for work as a construction laborer. Generally, applicants must be at least 18 years old and in good physical condition.	Construction laborers are usually the first workers to arrive on a construction project—assisting in site preparation—and the last to leave. After several years of experience and training, many laborers advance to craft jobs, such as carpenter, bricklayer, or cement mason. Some construction laborers are union members.
Drywall Installers and Finishers	Drywall installers create inside walls by fastening drywall panels to the framework inside houses and other buildings. Finishers do touchup work to get the panels in shape for painting. Most drywall installers and finishers work for contractors that specialize in drywall construction; others work for contractors that do all kinds of construction. In many small towns, carpenters install drywall and painters finish it.	Drywall installers and finishers usually start as helpers and learn most of their skills on the job. Some employers, in cooperation with unions, offer classroom instruction to supplement on-the-job training. Apprenticeship programs last about 2 years. Drywall installers must have the stamina to spend most of the day on their feet, standing, bending, stooping, or squatting. They must be able to lift and maneuver heavy panels.	Some drywall installers and finishers are union members.

Exploring Careers

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Electricians	Construction electricians install electrical systems that operate heating, lighting, power, air-conditioning, and refrigeration components. These workers also install electrical machinery, electronic equipment and controls, and signal and communications systems. Most construction electricians work for electrical contractors. Many others are self-employed contractors.	Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn the electrical trade. However, some people learn the trade informally by working for many years as electricians' helpers. Many helpers gain additional knowledge through trade school or correspondence courses, or through special training in the Armed Forces. Electricians must be able to work in cramped places and in awkward positions, to stand for long periods of time, and to climb ladders and balance themselves while working. Finger dexterity is important for working rapidly and accurately with small handtools such as pliers, screwdrivers, and knives. Normal color vision is important because workers frequently must identify wires by color. A license is necessary for employment as an electrician in some cities.	The seasonal nature of construction work affects electricians less than workers in most building trades, because so much of their work is indoors. Many electricians are union members.
Elevator Constructors	Elevator constructors assemble and install elevators, escalators, and similar equipment. After it is in service, they maintain and repair it. Most elevator constructors are employed by elevator manufacturers. Others are employed by small, local contractors who specialize in elevator maintenance and repair. Still others work for government agencies or business establishments that do their own elevator maintenance and repair.	Almost all elevator constructors learn their job primarily through on-the-job training supplemented by classroom instruction. A trainee usually can become a fully qualified constructor within 4 years. A high school education is required. Some States and cities require elevator constructors to pass a licensing examination. To install and repair modern elevators, elevator constructors must have a working knowledge of electricity, electronics, and hydraulics. They also must be able to repair electric motors, control systems, and signal systems. Because of the variety of their work, they use many different handtools, power tools, and testing meters and gauges. The ability to work at great heights without fear is important.	Unlike most other construction trades people, elevator constructors usually work year round. When construction of new buildings declines, the construction of new elevators and escalators does also, but the demand for the repair and maintenance of older elevators and escalators remains constant. Most elevator constructors are union members.

Construction Occupations

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Floor Covering Installers	Floor covering installers install and replace carpet or resilient floor covering materials such as tile, linoleum, and vinyl sheets. Most installers work for flooring contractors. Many others work for retailers of floor covering and home alteration and repair contractors. About four-fifths work primarily with carpet, and the remainder with resilient flooring. About 1 out of 4 floor covering installers is self-employed, a higher proportion than the average for all building trades. Installers are employed throughout the Nation, but most are concentrated in urban areas that have high levels of construction activity.	The vast majority of floor covering installers learn their trade informally on the job by working as helpers to experienced installers. Most others learn through formal apprenticeship programs, which include on-the-job training as well as related classroom instruction. Courses in general mathematics and shop may provide a helpful background for floor covering work. High school graduates are preferred. Floor covering installers must be able to stand, bend, and kneel for long periods of time, to work in awkward positions, and to work rapidly and accurately with small handtools.	Floor covering installers generally specialize in either carpet or resilient floor covering installation, although some do both types. Many floor covering installers are union members.
Glaziers	Construction glaziers cut and install all types of building glass, including windows, glass doors, and mirrors, and also install steel sash. Most glaziers work for glazing contractors in new construction, alteration, and repair. Others work for government agencies or businesses that do their own construction work. Glaziers work throughout the country, but jobs are concentrated in metropolitan areas. Glaziers occasionally may travel to work for a day or two in small outlying towns where few people, if any, are equipped and qualified to install glass in commercial buildings such as stores.	Most glaziers learn their trade through a 4-year apprenticeship program. Others learn the trade informally on the job by assisting experienced workers. Learning the trade through on-the-job experience can take considerably longer than through apprenticeship. A high school diploma is generally desired for helpers, and is required for apprenticeship applicants. Courses in general mathematics, blueprint reading or mechanical drawing, general construction, and shop provide a helpful background. Glaziers need manual dexterity and the physical ability to carry plates of glass and climb, reach, and stretch while installing the glass.	Many glaziers are union members.

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Insulation Workers	Insulation workers cover surfaces such as walls, ducts, pipes, and tanks with insulation materials that prevent excessive loss of cool or hot air. Most insulation workers work for insulation contractors. Others are employed to alter and maintain insulated pipework in chemical factories, petroleum refineries, power plants, and similar structures which have extensive steam installations for power, heating, and cooling. Some large firms which have cold-storage facilities also employ these workers for maintenance and repair.	Almost all insulation workers learn their trade through either informal on-the-job training or a formal 4-year "improvership" program similar to apprenticeship. A high school diploma is preferred for entry level jobs, and is required for improvership positions. High school courses in blueprint reading, shop math, and general construction provide a helpful background. Insulation workers must have the physical stamina to spend most of the day on their feet, standing, bending, stooping, or squatting. They should not be afraid to work on ladders or in tight spaces.	Many insulation workers are union members.
Ironworkers	Ironworkers put up the steel framework and other metal parts of buildings, bridges, and other structures. They also deliver heavy machinery to new sites. Most ironworkers work for general contractors, steel erection contractors, or ornamental iron contractors. Many work for large steel companies or their subsidiaries engaged in the construction of bridges, dams, and large buildings. Some work for government agencies, public utilities, or large industrial firms that do their own construction work.	Most training authorities recommend the completion of an apprenticeship as the best way to learn these trades. Some people, however, learn the trades informally by working as helpers to experienced ironworkers. Applicants for the 3-year apprenticeship program generally must have a high school education. Courses in general mathematics and mechanical drawing provide a helpful background. Since materials used in ironworking trades are heavy and bulky, above-average physical strength is necessary. Agility and a good sense of balance also are required in order to work at great heights and on narrow footings.	Ironworkers comprise four related trades—structural ironworkers, riggers and machine movers, ornamental ironworkers, and reinforcing ironworkers. Many ironworkers are skilled in two of these trades or more. Ironwork can involve considerable travel because demand in an area may be insufficient to keep local crews continually employed. Many ironworkers are union members.

Construction Occupations

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Lathers	Lathers install lath—the base for wet cement—plaster, or stucco on walls and ceilings. Most lathers work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. A relatively small number of lathers are employed outside the construction industry; for example, some make the lath backing for plaster display materials or scenery.	Although many lathers acquire their skills on the job, apprenticeship is recommended. Apprenticeship programs usually last a minimum of 2 years, and include classroom instruction in applied mathematics, blueprint reading, sketching, estimating, basic welding, and safety. Apprenticeship applicants usually are required to have a high school education or its equivalent. Courses in general mathematics and mechanical drawing can provide a helpful background. Lathers need manual dexterity and mechanical ability. Although a lather's work is not strenuous, it does require standing, squatting, or working overhead for long periods.	Many lathers are union members.
Operating Engineers	Operating engineers run the power construction equipment used to excavate and grade earth, erect structural and reinforcing steel, and pour concrete. Workers are often identified by the type of machine they operate. For example, they may be known as crane operators, bulldozer operators, or derrick operators. Most operating engineers work for contractors in highway, dam, airport, and other large-scale construction projects. Others work for utility companies, manufacturers, and other business firms that do their own construction work, as well as State and local highway and public works departments. Some work in factories and mines to operate cranes, hoists, and other power-driven machinery.	Most training authorities recommend completion of a 3-year apprenticeship as the best way to become an operating engineer. Apprentices learn to operate a variety of machines, and receive classroom instruction in engine operation and repair, cable splicing, hydraulics, welding, and safety and first aid. Less extensive training is available through special heavy-equipment training schools. Courses in driver education and automobile mechanics provide a helpful background. Experience in operating tractors and other farm machinery also is helpful. Operating engineers need stamina to withstand high noise levels and constant shakes and jolts from the machines.	The range of skills for operating engineers may vary widely because they work with many different types of machines. Heavy machines (like large cranes) are usually complex and difficult to operate; medium-sized equipment (like bulldozers) generally requires less skill, and lightweight equipment (such as air compressors) is the easiest to operate. Some operating engineers know how to operate several kinds of machines. Many operating engineers are union members.

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Painters and Paperhangers	Painters apply coats of paint, varnish, stain, enamel, or lacquer to decorate and protect building surfaces. Paperhangers cover walls and ceilings of rooms with decorative wallpaper, fabrics, vinyl, or similar materials. Many painters and paperhangers work for contractors who do new construction, repair, alteration, or modernization work. Many organizations that own or manage extensive property holdings also employ maintenance painters. A high proportion of workers in these trades are in business for themselves.	Most training authorities recommend the completion of a formal apprenticeship as the best way to become a painter or paperhanger. However, because apprenticeship programs are limited, many new workers begin as helpers to experienced painters. Generally, painters only paint. Paperhangers, however, both paint and hang wallpaper. As a result, paperhangers require more training and additional skills, and a larger percentage of paperhangers than painters are trained through apprenticeship. A high school education is preferred for both occupations. Painters and paperhangers must have stamina, because their jobs require a considerable amount of climbing and bending, as well as standing for long periods. Painters in particular should not be afraid of heights. A painter also must have strong arms, because much of the work is done with arms raised overhead. Manual dexterity and good color sense are important.	Many painters and paperhangers are union members.
Plasterers	Plasterers apply coats of plaster to finish interior walls and ceilings. They apply durable cement plaster or stucco to exterior surfaces. Plasterers work mostly on new construction and alteration work, particularly where special architectural and lighting effects are part of the job. Some plasterers repair older buildings.	Most training authorities recommend completion of a 3- or 4-year apprenticeship as the best way to learn plastering. However, many people learn the trade by working as helpers or laborers, observing and being taught by experienced plasterers. Courses in general mathematics, mechanical drawing, and shop provide a useful background. Manual dexterity is important. Strength and stamina are also necessary, because plastering requires considerable standing, stooping, and lifting.	Many plasterers are union members.

Construction Occupations

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Plumbers and Pipefitters	Plumbers and pipefitters assemble, install, and repair pipe systems that carry water, steam, air, or other liquids and gases. They also install plumbing fixtures, appliances, and heating and refrigeration units. Most plumbers and pipefitters work for plumbing and pipefitting contractors engaged in new construction activity, and work mainly at the construction site. Many plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers install and maintain pipe systems for government agencies and public utilities, and some work on the construction of ships and aircraft. Others do maintenance work in industrial and commercial buildings. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-processing industries where manufacturing operations include the processing of liquids and gases through pipes.	A 4-year apprenticeship including related classroom instruction is recommended as the best way to learn all aspects of the plumbing or pipefitting trade. However, many people learn plumbing or pipefitting by working for several years as helpers to experienced plumbers or pipefitters. A high school or vocational school education is recommended. Courses in chemistry, general mathematics, mechanical drawing, physics, and shop are helpful. Some localities require workers to pass a licensing examination. Manual dexterity and mechanical ability are important. Plumbers must also be able to stand for long periods and occasionally must work in cramped or uncomfortable positions.	Many plumbers and pipefitters and union members.
Roofers	Roofers install and repair roofing using such materials as sheet metal, tile, slate, asphalt shingles, composition, felt, tar, and gravel. They may also waterproof walls and floors. Most roofers work for roofing contractors on construction or repair jobs. Some work for businesses and government agencies that do their own construction and repair work. A few roofers are self-employed.	A 3-year apprenticeship including related classroom instruction is recommended. Most roofers, however, acquire their skills informally by working as helpers for experienced roofers. A high school education is helpful for people interested in becoming roofers. Courses in mechanical drawing and basic mathematics are especially helpful. Good physical condition, a good sense of balance, and an ability to work at heights without fear are important assets.	Roofers have to be outdoors in all kinds of weather, and the work can be very hot in the summer months. Many roofers are union members.

Occupation	*Nature and Places of Work*	*Training and Qualifications*	*Other Information*
Sheet-Metal Workers	Sheet-metal workers make and install sheet-metal ducts for air-conditioning, heating, and ventilating systems; flat metal for kitchen walls and counters; and stamped metal for roofing and siding. Some workers specialize in onsite installation. Some work primarily in shops doing fabricating and layout work. Others do both. Sheet-metal workers in the construction industry are employed mainly by contractors who specialize in heating, refrigeration, and air-conditioning equipment, and by general contractors engaged in residential, industrial, and commercial building. Additional sheet-metal workers are employed by government agencies or businesses that do their own construction and alteration work. Very few are self-employed.	A 4-year apprenticeship program is recommended, and most sheet-metal workers learn their skills this way. Many others, however, have acquired their skills by working as helpers to experienced workers. A high school education is required for entry to apprenticeship programs, and courses in mathematics, mechanical drawing, and shop provide a helpful background. Sheet-metal workers need to be able to work high above the ground at times. At other times, they must be able to work in cramped and awkward positions. Good physical condition is important.	Many sheet-metal workers are union members.
Tilesetters	Tilesetters apply tile to floors, walls, and ceilings. Tilesetters are employed mainly in nonresidential construction projects, such as schools, hospitals, and public and commercial buildings. A significant proportion of tilesetters—about 1 out of 5—is self-employed.	A 3-year apprenticeship program is recommended as the best way to learn tilesetting. Many tilesetters, however, acquire their skills informally by working as helpers to experienced workers. When hiring apprentices or helpers, employers usually prefer high school or vocational school graduates who have had courses in general mathematics, mechanical drawing, and shop. Good physical condition, manual dexterity, and a good sense of color harmony are important assets.	Since tilesetters work mostly indoors, the annual number of hours they work generally is higher than some of the other construction crafts. Many tilesetters are union members.

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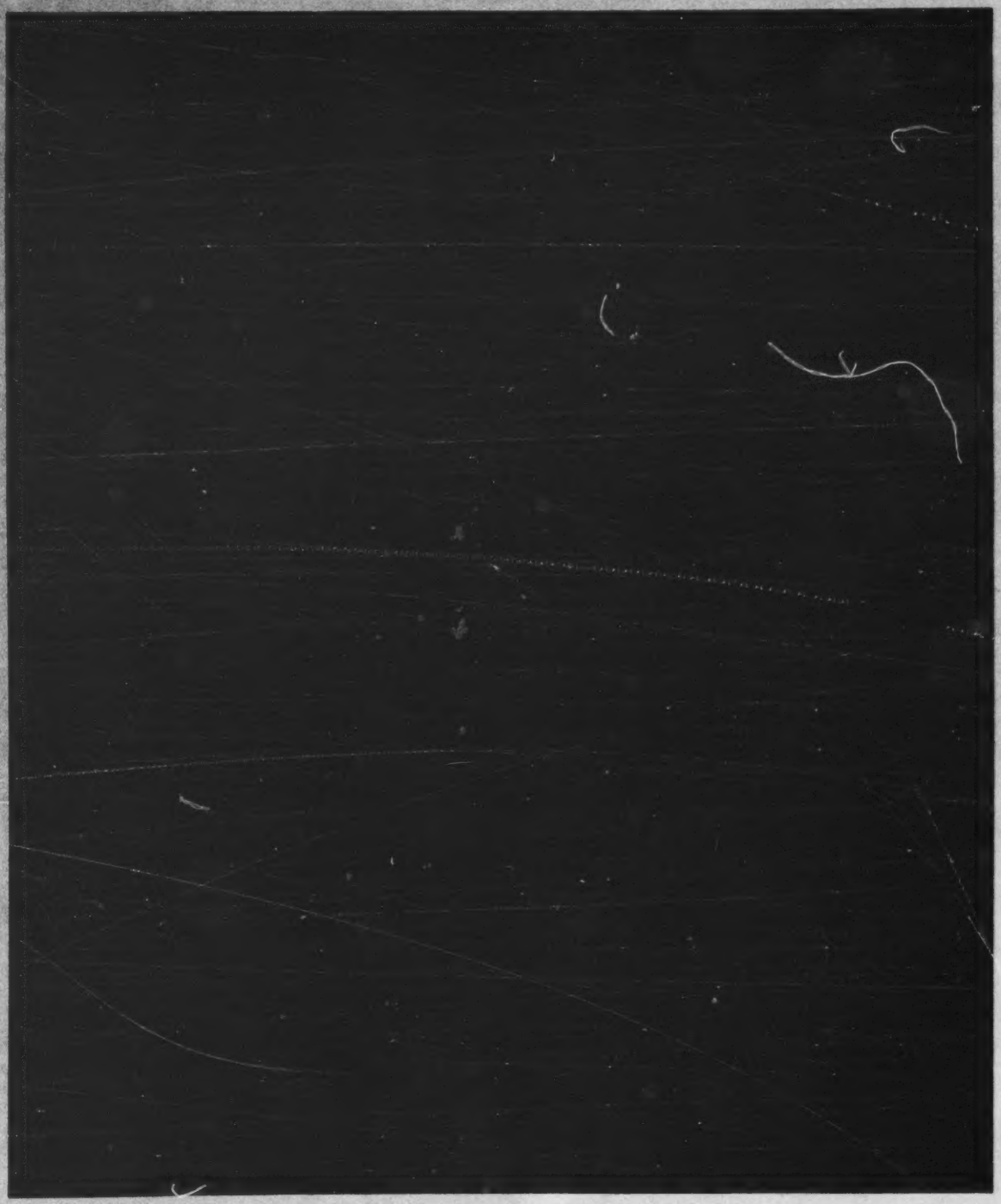


Apprenticeship training helped this carpenter develop a high standard of workmanship.

Answers to Related Occupations

BRICKLAYER

1. Cement mason, 2. Tilesetter, 3. Terrazzo worker, 4. Stonemason, 5. Hod carrier or mason tender, 6. Marble setter.

CARPENTER

1. d, 2. e, 3. g, 4. f, 5. a, 6. c, 7. b.

PLUMBER

1. Air-conditioning, refrigeration, and heating mechanic, 2. Welder, 3. Sheet-metal worker, 4. Water treatment plant operator, 5. Sprinkler fitter.

Answers to math problems

BRICKLAYER

212 inches or 17⅔ feet, 12 hours or 1½ days, 3,080 bricks, 8.75 cubic yards.

CARPENTER

10 turns, 48 boards, 6⅜ inches, 35 hours = 4⅜ 8-hour days.

PLUMBER

25.5 pounds per square inch, 13.5 feet, 60 pounds, 96⅜ feet, 9 gallons weighing 75 pounds.

Occupational Outlook Handbook

One of the most widely used resources in the field of vocational guidance, the Handbook is an "encyclopedia of careers" covering several hundred occupations. A new edition is published every 2 years. The reader will find information on

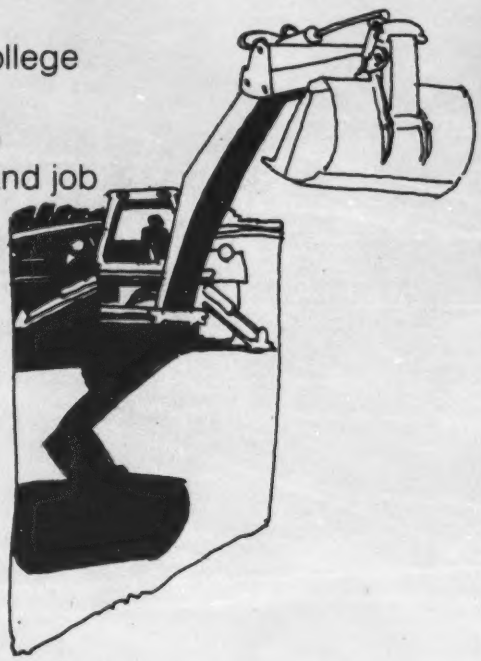
- What the work is like
- Job prospects
- Personal qualifications
- Education and training requirements
- Earnings
- Related occupations
- Where to find additional information.

Contact any of the BLS Regional Offices listed inside the back cover for price and ordering information.

Occupational Outlook Quarterly

A periodical to help students, job seekers, counselors, and education planners keep up with occupational and employment developments. The Quarterly is written in nontechnical language and illustrated in color. Articles cover such topics as these:

- Job prospects for college graduates
- How to look for a job
- Matching personal and job characteristics



For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Subscription price per year (4 issues) is $6 domestic, $7.50 foreign, single copy $1.75. Prices are subject to change.

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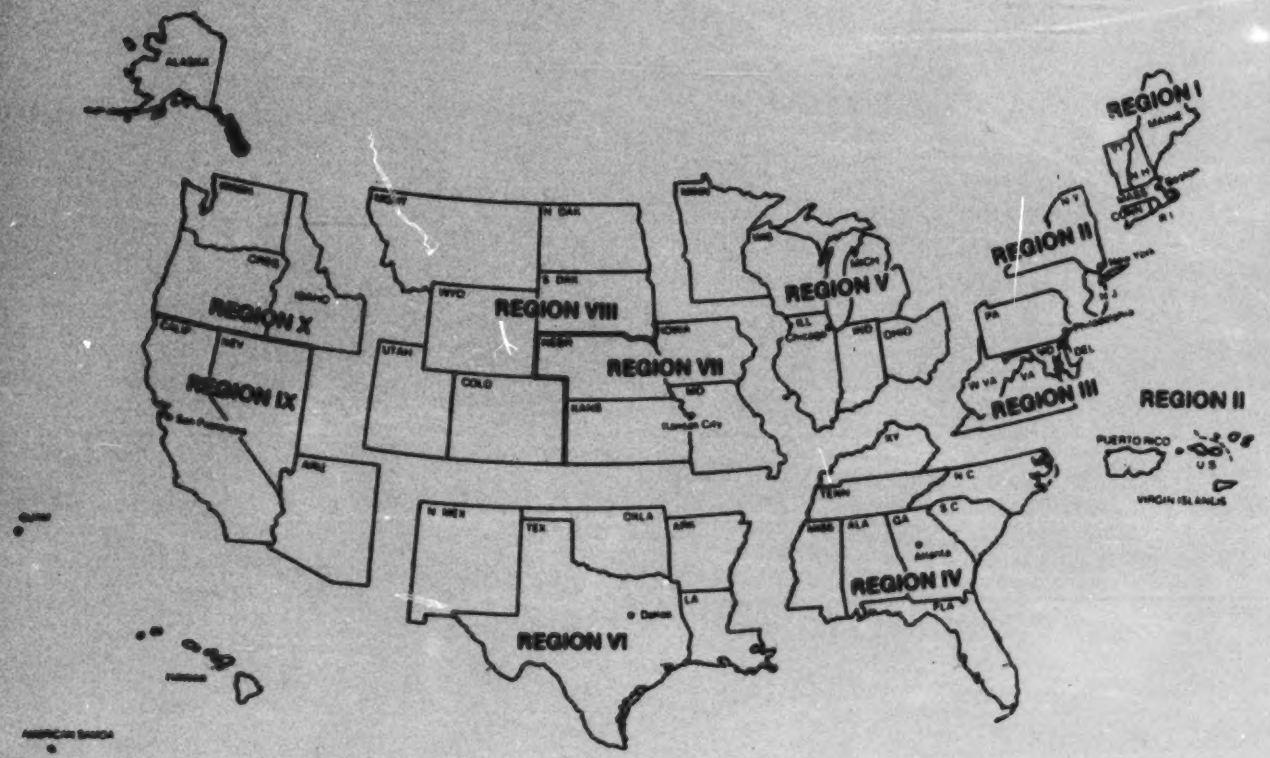

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